Remarks

Status of the Claims

Claims 24-27 are pending in the application. Claims 28-31 are new. Support for Claims 28-30 can be found, for example, in the specification on page 6, line 13 through page 7, line 1 and in **Figures 2a-c** and **3**. Support for Claim 31 can be found, for example, page 5, lines 5-6. Support for Claim 32 can be found, for example, on page 7, lines 1-3.

Applicant initially confirms the election to prosecute the invention of Group I, Claims 24-25 in response to the restriction requirement made by the Examiner. Claims 26-27 have been cancelled without prejudice.

Claims 24 and 25 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Charlier et. al, *Structural and electronic properties of pentagon-heptagon pair defects in carbon nanotubes*, Phys. Rev. B., Vol. 53, No. 16, 11 108-113 (hereinafter "Charlier"). Applicants respectfully submit that Charlier does not teach or suggest "a dipole of pentagon-heptagon and heptagon-pentagon dislocation cores "and "a domain of modified lattice structure positioned between said dipole" as claimed in the current application.

Charlier discloses "5/7" or pentagon-heptagon defects on the cylindrical surface of a zigzag (n, 0) nanotube. As noted in the Action, Charlier teaches that such defects create a small local deformation in the width of the nanotube and, in some instances, a small change in the helicity. Charlier proposes six types of defect configurations as shown in **Figure 1a** on page 109. The configurations discussed in Charlier include a single 5/7 defect (Ia), two 5/7 defects positioned at opposite sides of the conical surface (IIa), two 5/7 defects aligned on the tube axis (IIb), two 5/7 defects side-by-side (leading to a 5/6/7 defect) (IIc), three 5/7 defects positioned as far as possible from each other on the conical surface (IIIa), and three 5/7 defects aligned along the tube axis (IIIb). The configurations with more than one 5/7 defect are arranged either aligned along the tube axis (IIb, IIc, or IIIb) or along the conical axis (IIa, IIIa). See **Figure 1a**, page 109.

The Action correctly notes that Charlier teaches that the 5/7 defects may be common in carbon nanotubes, but normally go undetected because they cancel each other out when randomly aligned. Thus, Applicant submits that Charlier merely discloses the existence of 5/7 defects in carbon nanotubes. Charlier does not teach or suggest a modified lattice

structure positioned between a dipole of pentagon-heptagon and heptagon-pentagon dislocation cores as recited in the claims.

In contrast to Charlier, Claim 24 recites a carbon nanotube comprising:

> a dipole of pentagon-heptagon and heptagon-pentagon dislocation cores located in an opposed spaced-apart relationship along a longitudinal axis of said carbon nanotube;
>
> a first region comprising a domain of modified lattice structure positioned between said dipole and formed by said dipole propagating through the nanotube as a result of stress being applied to said nanotube;
>
> second and third regions each positioned on opposite sides relative to said first region, the second and third regions comprising lattice structure domains which differ from the domain of modified lattice structure in said first region such that said second and third regions possess a physical property different from the first region.

An example of a modified lattice structure **30c** positioned between a pentagon-heptagon dipole **30a** and a heptagon-pentagon dipole **30b** according the present invention is shown in **Figures 2b** and **2c** in the current application. When stress is applied to the nanotube, the region between the dipole **30a, 30b** propagates into a new lattice structure **30c** of hexagons having a modified orientation. **Figure 3** illustrates a spiral path of propagation **P** for the dipole **30a, 30b**. For example, stress applied to a (10,10) nanotube having a chiral angle of 30° can result in a region where then nanotube has a chiral angle of 28° (for a (10,9) nanotube). This region of modified lattice structure is positioned between a dipole of pentagon-heptagon and heptagon-pentagon dislocation pairs. See specification, page 6, line 13 – page 7, line 1.

Without wishing to be bound by any particular theory, the dramatically different small, local deformities disclosed in Charlier may differ from the claimed configurations because of the dramatically different methods that can be used to form nanotubes. Such methods are the subject of parent application Serial No. 09/186,396, now issued U.S. Patent No. 6,280,677. Nantubes according to embodiments of the present invention can be formed by the application of stress sufficient to disrupt the lattice structure and form a dipole of dislocation cores. As described above, the dislocation cores split and propagate in the nanotube in a manner such that the dislocation cores are separated by a domain of modified

structure. Examples of the domain of modified structure include modified hexagonal lattice structures, for example, having a modified chirality. In contrast, Charlier discloses naturally occurring, small, localized 5/7 defects, and apparently does not propose any method for forming such defects.

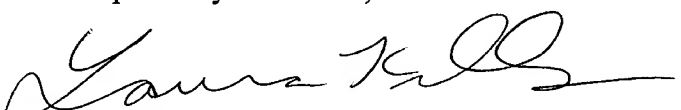
Therefore, Charlier does not anticipate the claimed invention because Charlier merely discloses localized and naturally occurring 5/7 defects and does not disclose a modified lattice structure positioned between a dipole. Accordingly, Applicant requests that the rejection under § 102 be withdrawn.

In addition, the claimed invention is not obvious in light of Charlier because Charlier teaches away from the claimed invention. Charlier is, among other things, concerned with eliminating 5/7 pair defects to improve consistency and quality and proposes that 5/7 pair defects can annihilate when oriented in opposite directions. See Charlier, page 113, first paragraph ("It might be not possible to eliminate all the 5/7 pair defects by annealing but it should improve the consistency and quality of the measured results."). Thus, Applicant submits that the claimed invention is not taught or suggested by Charlier.

Conclusion

Applicant respectfully submits that, for the reasons discussed above, the present case is in form for allowance. Accordingly, Applicant requests allowance of all the pending claims and passage of this application to issue.

Respectfully submitted,



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